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Wireless packet repeater for wireless communication system, transmits request-to-send packet for indicating completion of data transmission which is redirected so as to resume data transmission to next repeater

NIPPON TELEGRAPH & TELEPHONE CORP 2000.02.16 2000JP-038681

(2001.08.24) H04Q 7/38, H04B 7/15, 7/26, H04L 12/28, 12/56, 29/08

Novelty: A repeater receives data packets from transmitter (1) and when reception of data packet is completed, a request-to-send (RTS) packet is transmitted back to the transmitter indicating completion which is redirected back to the next repeater. The repeater on receiving RTS packet transmits a clear-to-send (CTS) packet indicating that data can be received and data transmission to next repeater is started.

Detailed Description: An INDEPENDENT CLAIM is also included for the wireless packet relay method.

Use: For wireless communication system.

Advantage: As separate acknowledgement signal is not required, the transmission of data packets are performed quickly and efficiently.

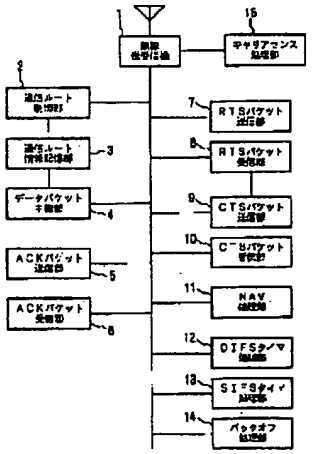
Description of Drawing(s): The figure shows the block diagram of wireless packet repeater. (Drawing includes non-English language text).

Transmitter 1

(8pp Dwg.No.1/4)

N2001-463791

W01-B05A1



PATENT ABSTRACTS OF JAPAN

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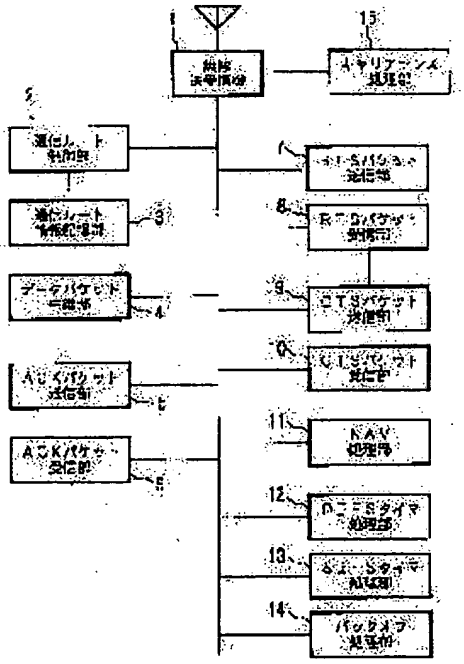
(54) RADIO PACKET RELAY STATION AND RADIO PACKET RELAY METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a radio packet relay station that can shorten the realy time of a data packet and can prevent the data packet from being transmitted to a destination station due to the data packet staying in the relay station.
SOLUTION: When a relay station completes reception of a data packet from a relay station being a sender, the relay station transmits an RTS packet in place of an ACK to the relay station of the sender, the relay station of the sender receiving the RTS packet recognizes that the relay station normally receives the data packet and stops data packet transmission preparation until the transmission of the data packet described in the RTS packet is finished. A next relay station receiving the RTS packet transmits a CTS packet to the relay station when the next relay station is ready to receive the data packet after an SIFS and the relay station receiving the CTS packet recognizes that the next relay station is ready to receive the data packet and transmits the data packet to the next relay station after the SIFS.



LEGAL STATUS

[Date of request for examination]

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CLAIMS

[Claim(s)]
[Claim 1] It is a wireless packet relay center in the communication system which two or more radio stations use a common wireless carrier, and transmits a wireless packet signal to an independence distribution target by carrying out junction processing to the radio station of a request of a wireless packet signal. The ready-for-sending acknowledgement function which transmits the signal for checking whether it is ready-for-sending ability to the next relay center after checking that carried out carrier sense between a certain fixed time amount Td, and the wireless circuit is vacant when the data signal which should be transmitted occurs, By said ready-for-sending acknowledgement function, when said next relay center is able to check that it is ability ready for receiving, a data signal The wireless packet transmitting function which transmits said data signal as a wireless packet signal after a certain fixed time amount Ts (Ts<Td) after being able to check, The ready-for-receiving notice function to transmit the signal which notifies that to the relay center of said front if it is ability ready for receiving when the signal for checking whether a self-relay center is ability ready for receiving about a data signal from the relay center in front of a self-relay center is received, The wireless packet reception function in which the relay center of said front receives the data signal which checked that a self-relay center was ability ready for receiving, and has been transmitted as a wireless packet signal by said ready-for-receiving notice function, In order to carry out junction processing of the data signal received by said wireless packet reception function The junction good acknowledgement function which transmits the signal for checking whether it is ready-for-sending ability to the next relay center after a certain fixed time amount Ts since it finishes receiving this data signal, The wireless packet junction function to transmit said data signal as a wireless packet signal after a certain fixed time amount Ts after it can check a data signal by said junction good acknowledgement function, when said next relay center is able to check that it is ability ready for receiving, A self-relay center supervises the signal which checks whether transmission of said data signal [further as opposed to the next relay center] of the next relay center which the next relay center transmits is possible. The wireless packet relay center characterized by providing the wireless packet signal junction acknowledgement function which checks that the wireless packet signal including the data signal which the self-relay center relayed has been normally received when reception of this signal is able to be checked.
[Claim 2] Two or more radio stations use a common wireless carrier, and it is in the wireless packet junction approach in the communication system which transmits a wireless packet signal to an independence distribution target by carrying out junction processing to the radio station of a request of a wireless packet signal. When a relay center carries out the completion of reception of the data packet from the relay center of a transmitting agency The wireless packet junction approach characterized by including the step which transmits the RTS packet which judges whether a data packet is ability ready for receiving instead of the ACK packet which tells having carried out normal reception of the data packet to the relay center of said transmitting origin.
[Claim 3] The relay center of said transmitting origin which received said RTS packet is time amount until transmission of the data packet which recognizes it as said relay center having carried out normal reception of the data packet, and is described by said RTS packet is completed, and the wireless packet junction approach according to claim 2 characterized by stopping a data packet transmitting preliminary treatment.

[Claim 4] Said relay center which transmitted the CTS packet for a transmitting check to said addressing to a relay center after between SIFS, and received this CTS packet when the next relay center which received said RTS packet was in the condition which self can data packet receive is the wireless packet junction approach according to claim 2 that a relay center besides the above is characterized by to recognize that it is in the condition in which data packet reception is possible, and to transmit said data packet to said following addressing to a relay center in between SIFS.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] In case the wireless packet junction approach in the wireless packet relay center which carries out the radio relay of the data packet, and this wireless packet relay center is started and a relay center transmits a data packet to the next relay center on the communication link root especially, this invention is making the preparations which transmit quickly the data packet transmitted from the relay center of the communication link root kickback to the next relay center, and relates to the technique of relaying a data packet to a destination station quickly.
[0002]
[Description of the Prior Art] The "RTS-CTS-DATA-ACK" procedure of DCF (Distributed Coordination Function) of CSMA/CA defined by IEEE802.11 which is performing the global standardization, for example as a conventional technique of the wireless packet junction approach (the wireless access approach) that each stations in which a key station does not exist share a circuit mutually autonomously is well-known. This procedure is described by "IEEE P 802.11, Draft Standard for Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, P802.11 D 6.1, 9 May 1997." The conventional technique which applies this wireless access method to a radio relay is explained below.
[0003] Drawing 4 is the explanatory view having shown the junction procedure of the conventional radio relay station (wireless packet relay center). A relay center A is drawing having shown the example the relay center B is similarly relaying [example] the data packet which received to the relay center C to the relay center B.
[0004] A relay center A receives a data packet, and after it transmits the acknowledge (ACK) packet which shows the completion of reception of a data packet, it starts the processing which transmits a relay center B HEDETA packet. While a relay center A is called DIFS (DCF Inter Frame Space), other terminals supervise whether the circuit is used or not (it is called carrier sense below). Between DIFS(s), if it recognizes that the circuit is not used after performing carrier sense, the next processing will be started.
[0005] Here, when the circuit is used between DIFS(s), a circuit is vacant after that, and only while generating the random number and being specified with the value, the back-off processing which performs carrier sense is again started after the carrier sense of DIFS time amount. It becomes possible to reduce the probability of the collision with other stations because each station performs back-off processing.
[0006] After performing back-off processing between DIFS(s) or after between DIFS, a relay center A describes time amount until transmission of a data packet completes the RTS packet for judging whether a relay center B is in the condition that a data packet is receivable if it recognizes that the circuit is not used as a result of carrier sense in the meantime, and it transmits to relay center B.
[0007] Relay centers other than the relay center B which received the RTS packet recognize that the relay center A tends to transmit the data packet after this, and begin the carrier sense between DIFS (s) after the time amount described in this.
[0008] If it recognizes that it is in the condition that a data packet is receivable, the relay center B which received the RTS packet is spacing called SIFS (Short Inter Frame Space), will describe time amount until a relay center A completes transmission of a data packet for the CTS packet which is a

packet for a transmitting check, and will transmit it to relay center A.
[0009] relay centers other than the relay center A which received the CTS packet (for example, the relay center C) recognize that the relay center B tends to receive the data packet, and it is described in this -- time amount standby is carried out and the carrier sense between DIFS(s) is begun after that. The relay center A which received the CTS packet becomes possible [recognizing that it is in the condition that a relay center B is receivable], and transmits a data packet in between SIFS.
[0010] The relay center B which received the data packet will transmit the ACK packet which tells having received the data packet normally in between SIFS, if it recognizes having received the data packet normally. Each relay center repeats the same processing as the above, and a data packet is relayed to a destination station.
[0011]
[Problem(s) to be Solved by the Invention] As a technical problem which this invention tends to solve, when a relay center B carries out the completion of reception of a data packet in drawing 4 which is the sequence diagram of the conventional technique and an ACK packet is transmitted to a relay center A, the case where the data packet of the waiting for transmission is in a relay center A is considered. Relay centers A and B perform carrier sense between DIFS(s) in order to start the preparation which transmits a data packet.
[0012] Here, after being able to check that the carrier is vacant as a result of the carrier sense within between DIFS, each station generates a random number and starts the back-off processing only whose time amount specified with the value continues carrier sense. In this case, when a relay center A becomes ready-for-sending ability with a value smaller than a relay center B, a relay center B will refrain from data packet transmitting preparation until it will complete transmission of the data packet from a relay center A, if the RTS packet from a relay center A is received.
[0013] When it may be such and the count of junction increases repeatedly, there is a trouble that the time amount a relay center B relays [time amount] a data packet to a relay center C becomes late, and the throughput of the data packet to a destination station becomes low.
[0014] Moreover, even if the relay center B transmitted the data packet previously as one of the technical problems which this invention tends to solve on the occasion of back-off processing in the above-mentioned case, it will pass through the time amount of ACK air time +SIFS time amount +DIFS time amount (+ back-off processing time) by starting transmission of the data packet which the relay center A transmitted (RTS being transmitted). Therefore, there is a trouble that the junction of a data packet becomes slow and a throughput becomes low.
[0015] The purpose of this invention aims at offering the wireless packet relay center and the wireless packet junction approach which it was made since the above-mentioned technical problem was solved, and the time amount concerning junction processing of a data packet can be shortened, and a data packet is not overdue in a relay center, and can be quickly transmitted to a destination station.
[0016]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the description of invention of claim 1 It is a wireless packet relay center in the communication system which two or more radio stations use a common wireless carrier, and transmits a wireless packet signal to an independence distribution target by carrying out junction processing to the radio station of a request of a wireless packet signal. The ready-for-sending acknowledgement function which transmits the signal for checking whether it is ready-for-sending ability to the next relay center after checking that carried out carrier sense between a certain fixed time amount Td, and the wireless circuit is vacant when the data signal which should be transmitted occurs, By said ready-for-sending acknowledgement function, when said next relay center is able to check that it is ability ready for receiving, a data signal The wireless packet transmitting function which transmits said data signal as a wireless packet signal after a certain fixed time amount Ts (Ts<Td) after being able to check, The ready-for-receiving notice function to transmit the signal which notifies that to the relay center of said front if it is ability ready for receiving when the signal for checking whether a self-relay center is ability ready for receiving about a data signal from the relay center in front of a self-relay center is received, The wireless packet reception function in which the relay center of said front receives the data signal which checked that a self-relay center was ability ready for receiving, and has been

transmitted as a wireless packet signal by said ready-for-receiving notice function, In order to carry out junction processing of the data signal received by said wireless packet reception function The junction good acknowledgement function which transmits the signal for checking whether it is ready-for-sending ability to the next relay center after a certain fixed time amount Ts since it finishes receiving this data signal, The wireless packet junction function to transmit said data signal as a wireless packet signal after a certain fixed time amount Ts after it can check a data signal by said junction good acknowledgement function, when said next relay center is able to check that it is ability ready for receiving, A self-relay center supervises the signal which checks whether transmission of said data signal [further as opposed to the next relay center] of the next relay center which the next relay center transmits is possible. When reception of this signal is able to be checked, it is in providing the wireless packet signal junction acknowledgement function which checks that the wireless packet signal including the data signal which the self-relay center relayed has been received normally.

[0017] A wireless carrier with two or more common radio stations is used for the description of invention of claim 2. It is in the wireless packet junction approach in the communication system which transmits a wireless packet signal to an independence distribution target by carrying out junction processing to the radio station of a request of a wireless packet signal. When a relay center carries out the completion of reception of the data packet from the relay center of a transmitting agency It is in the step which transmits the RTS packet which judges whether a data packet is ability ready for receiving instead of the ACK packet which tells having carried out normal reception of the data packet to the relay center of said transmitting origin being included.

[0018] The relay center of said transmitting origin the transmitting description of invention of claim 3 received said RTS packet is to stop time amount until transmission of the data packet which recognizes it as said relay center having carried out normal reception of the data packet, and is described by said RTS packet is completed, and a data packet transmitting preliminary treatment.

[0019] If the next relay center which received said RTS packet of invention of claim 4 is in the condition which self can data packet receive, it will recognize that said relay center which transmitted the CTS packet for a transmitting check to said addressing to a relay center after between SIFS, and received this CTS packet is in the condition which a relay center besides the above can data packet receive, and said data packet will be transmitted to said following addressing to a relay center in between SIFS.

[0020] According to this invention, when a relay center carries out the completion of reception of the data packet from the relay center of a transmitting agency, it has lost that a data packet is overdue in a relay center, and it becomes impossible to transmit instead of ACK quickly at a destination station while shortening the time amount which junction processing of a data packet takes by considering as the procedure of transmitting an RTS packet to the relay center of a transmitting agency.

[0021]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 is the block diagram having shown the configuration of 1 operation gestalt of the wireless packet relay center of this invention. The wireless packet relay center is equipped with a radio receiver-transmitter 1, the communication link root control section 2, the communication link root information storage section 3, the data packet junction section 4, the ACK packet transmitting section 5, the ACK packet receive section 6, the RTS packet transmitting section 7, the RTS packet receive section 8, the CTS packet transmitting section 9, the CTS packet receive section 10, the NAV processing section 11, the DIFS timer processing section 12, the SIFS timer processing section 13, the back-off processing section 14, and the carrier sense processing section 15.

[0022] Here, a radio receiver-transmitter 1 performs radio between the wireless packet relay center concerned and other wireless packet relay centers. The communication link root control section 2 manages the address of the station at the time of transmitting each packet etc. based on the communication link root information memorized in the communication link root information storage section 3. The data packet junction section 4 holds the data packet which received, and makes the preparations which relay a data packet with reference to the address obtained by the communication link root control section 2. If it checks that the data packet is normally receivable, the ACK packet

transmitting section 5 will create the ACK packet for telling that, and will make the preparations for transmission.

[0023] The ACK packet receive section 6 recognizes having completed transmission of a data packet to a transmitting partner's station normally, after receiving an ACK packet. In case the RTS packet transmitting section 7 has the Request to Send of a data packet, it creates an RTS packet, describes the time amount (Duration) which transmission of a data packet completes, and prepares transmission. After it receives the RTS packet transmitted from the station, the RTS packet receive section 8 recognizes the address of a transmission place, when a transmission place is an own terminal, it moves to the CTS packet transmitting section 9, and when a transmission place is not an own terminal, it moves to the NAV processing section 11.

[0024] From the RTS packet receive section 8, when there is a demand of CTS packet creation, the CTS packet transmitting section 9 creates a CTS packet, describes the time amount (Duration) which transmission of a data packet completes, and prepares transmission. After it receives a CTS packet, the CTS packet receive section 10 recognizes the address of a transmission place, when a transmission place is an own terminal, it moves to preparation of data packet transmission in the data packet junction section 4, and when a transmission place is not an own terminal, it moves to the NAV processing section 11.

[0025] The NAV processing section 11 stands by the transmitting processing of RTS (DIFS timer + back-off processing) and a CTS packet which is a data packet transmitting preliminary treatment to the Duration time amount described in RTS or CTS. When the DIFS timer processing section 12 has a data packet Request to Send, it performs carrier sense by the carrier sense processing section 15 only between the DIFS time amount set up beforehand, and supervises whether there is any transmission of the packet from other stations. If processing of the packet from other stations is recognized, after starting a DIFS timer again and carrying out timer expiration from the moment transmission of a packet finished and the circuit was vacant, it moves to the back-off processing section 14. When the SIFS timer processing section 13 has the Request to Send of a CTS packet, an ACK packet, and a data packet, it makes preparations of transmission only between the SIFS time amount set up beforehand.

[0026] When a DIFS timer becomes time amount expiration by back-off processing in the DIFS timer processing section 12, the back-off processing section 14 generates a random number, performs carrier sense by the specified time amount carrier sense processing section 15, and supervises whether there is any transmission from other packets. Here, if transmission of the packet from other stations is recognized, it will move to the DIFS timer processing section 12.

[0027] Drawing 2 is the explanatory view having shown 1 operation gestalt of the wireless packet junction approach of this invention, and explains the transceiver procedure at the time of transmitting a data packet to the wireless packet relay center C through the wireless packet relay center B from the wireless packet relay center A of a configuration of having been shown in drawing 1 .

[0028] Drawing 3 is the sequence diagram having shown actuation of each station at the time of transmitting a data packet to the wireless packet relay center C through the wireless packet relay center B from the wireless packet relay center A in the transceiver procedure shown in drawing 2 .

[0029] Next, actuation of this operation gestalt is explained with reference to drawing 2 and drawing 3 . Drawing 2 and drawing 3 show the situation of relaying the data packet in order of relay centers B and C, from the transmitting agency office A. The transmitting agency station A prepares (step 301a) and an RTS packet, when there is a demand of data packet transmission. In case the transmitting agency station A transmits an RTS packet, while being referred to as DIFS, it performs carrier sense as well as the conventional technique (step 302a). After performing carrier sense between DIFS(s), the packet is not transmitted from other stations, and if it recognizes that the circuit is vacant, an RTS packet will be transmitted to relay center B (step 303a). The time amount taken to complete transmission of a relay center B HEDETA packet from the transmitting agency station A into an RTS packet is described.

[0030] Here, if the packet transmission from other stations is checked in the carrier sense between DIFS(s), transmission of the packet of other stations will be completed and a DIFS timer will be again started from the moment of having recognized it as the circuit being vacant. A random number is generated after DIFS timer completion, and only while being specified with the value, the back-off

processing which performs carrier sense is started. In the meantime, an RTS packet will be transmitted if transmission of the packet from other stations is not sensed.
[0031] It judges whether a relay center B is in the condition that the data packet from the transmitting agency station A is receivable, when an RTS packet is received (step 301b). If it is not in a receivable condition, it will not answer (step 302b). If it is in a receivable condition, a CTS packet will be transmitted for the passage of time called SIFS to waiting (step 303b) and transmitting agency station A (step 304b). The time amount taken to complete transmission of a relay center B HEDETA packet from the transmitting agency station A like [a CTS packet] an RTS packet is described.
[0032] Here, only the time amount described in the CTS packet sets up NAV, and relay centers other than the transmitting agency station A which received the CTS packet (for example, the relay center C) suspend processing of data packet transmitting preparation.
[0033] A relay center B becomes possible [recognizing that it is in the condition in which data packet reception is possible], and the transmitting agency station A which received the CTS packet transmits a data packet for progress between SIFS(s) to waiting (step 304a) and relay center B (305a). An RTS packet is transmitted to relay center C which is the relay center of a waiting (step 305b) and communication link root top and a degree about the relay center B which received the data packet normally passing between SIFS(s) (step 306b).
[0034] The transmitting agency station A which received the RTS packet is receiving an RTS packet to the time amount which receives the ACK packet which originally notifies the completion of normal transmitting of a data packet, and it recognizes that transmission of the data packet to a relay center B was completed normally. Then, the transmitting agency office A sets up NAV and stops a data packet transmitting preliminary treatment until a relay center B completes transmission of the data packet addressed to a relay center C.
[0035] It judges whether the relay center C which received the RTS packet is in the condition which self can data packet receive (step 301c). If it is not in a receivable condition, it will not answer (step 302c). If it is in a receivable condition, a CTS packet will be transmitted for passing between SIFS(s) to waiting (step 303c) and relay center B (step 304c).
[0036] It becomes possible [the relay center B which received the CTS packet] to recognize that a relay center C is in the condition in which data packet reception is possible, and a data packet is transmitted for passing between SIFS(s) to waiting (step 307b) and relay center C (step 308b). The relay center C which received the data packet normally transmits an RTS packet to the relay center which is the next relay center on the communication link root after the progress between SIFS(s) (step 305c) (step 306c). Junction of a data packet is performed by being repeated until a data packet is sent for the above processing to a destination station in each relay center.
[0037] According to this operation gestalt, even when a relay center B carries out the completion of reception of the data packet from a relay center A and the data packet of the waiting for transmission is in a relay center A at this time in order to transmit not ACK but an RTS packet to a relay center A, a relay center B can send said data packet which received to a relay center C quickly in between SIFS. It can prevent that a data packet is overdue in a relay center B, and junction processing of a data packet becomes impossible very much by this.
[0038] Moreover, originally, by making the function of the ACK packet which notifies the completion of normal reception of a data packet to the RTS packet which judges whether it is ability ready for receiving hold, a data packet can shorten the time amount equivalent to ACK air time +DIFS time amount (+ back-off processing time), can shorten the time amount concerning junction processing of a data packet, and can make the throughput to the destination high.
[0039]
[Effect of the Invention] As explained to the detail above, by using the wireless packet relay center of this invention, and the wireless packet junction approach from a transmitting agency station to a destination station By making the function of the ACK packet which notifies the completion of normal reception of a data packet to the RTS packet which requests a transmitting check hold, in case a data packet is made to relay using a relay center The time amount equivalent to ACK air time +DIFS time amount (+ back-off processing time) can be shortened, and a relay center can relay a data packet quickly. Since this becomes possible to relay a data packet preferentially and a

transmitting agency station is still enabled to shorten the time amount to transmission of the following data packet, it is lost that a data packet is overdue in a relay center, and there is effectiveness which can be quickly relayed to a destination station.

[Translation done.]

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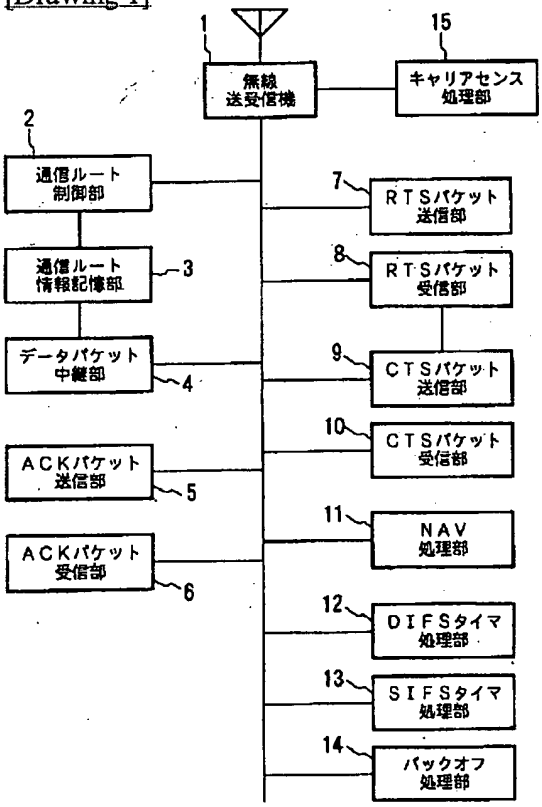
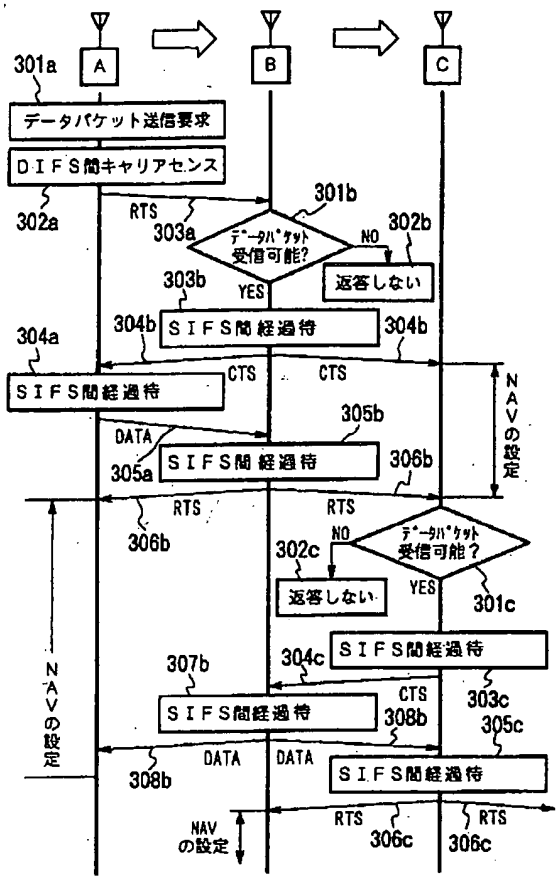
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

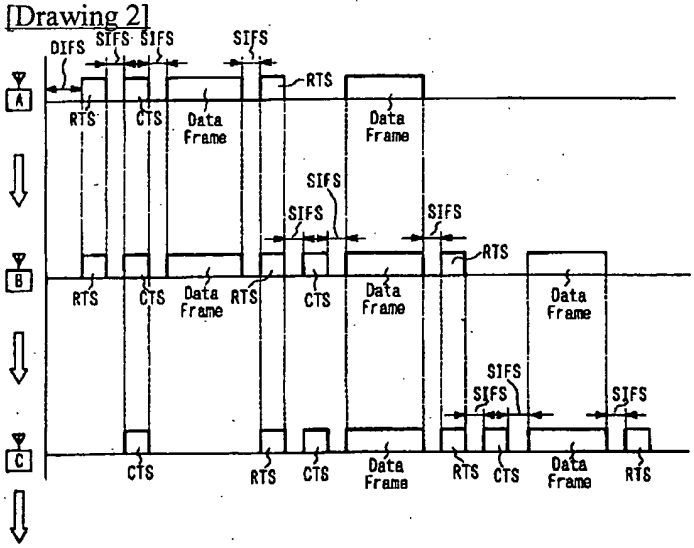
[Drawing 1]



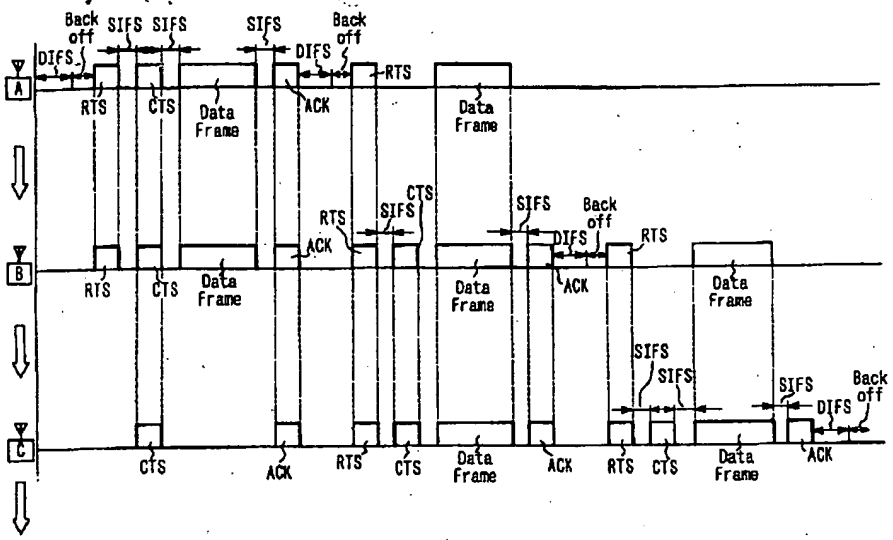
[Drawing 3]



[Drawing 2]



[Drawing 4]



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